

PROB 140 Fall 2020

WEEK 6 STUDY GUIDE



The Big Picture

We develop an algorithm that uses a Markov chain to simulate a probability distribution on an intractably large outcome space.

- Under some conditions that are pretty general, Markov chains have powerful long run properties.
- *Steady state* or *stationarity* has a physical interpretation and many uses.
- Many Markov chains, when run for a long time, exhibit different kinds of *balance*. These can be used to identify steady state properties.
- *Monte Carlo* methods use simulation to address problems that are intractable by math or by complete enumeration.
- *Markov Chain Monte Carlo* (MCMC) can be used to simulate probability distributions on intractably large outcome spaces, even when the normalizing constant of the distribution can't be calculated.

Week At a Glance

Mon 9/28	Tue 9/29	Wed 9/30	Thu 10/1	Fri 10/2
	Instructor's Session		Instructor's Session	
		GSI's Sessions		GSI's Sessions
Checkpoint Week 6 (Due Wed 9/30)		Checkpoint Week 6 Due		
Homework 5 (Due Mon 10/5)				HW 5 Party 6-7PM
Lab 3 (Due Mon 10/5)			Lab 3 Party 6-7PM	
Read Sec 10.1	Skim Sec 10.1-10.3	Read Ch 10, skim Sec 11.1	Read Ch 11	Read Ch 11

Reading, Practice, and Live Sessions

Sections	Topic	Live Sessions: Prof. A.	Live Sessions: GSIs	Recommended Practice
Ch 10	<p>Markov chains</p> <ul style="list-style-type: none"> - 10.1 (covered in Week 5) introduces terminology, notation, and basics, along with a computational approach to the long run - 10.2 narrows down the type of chain we'll be studying, but even the narrowed-down group is pretty large - 10.3 takes a more theoretical approach to the long run - 10.4 has examples and applications 	<p>Tuesday 9/29</p> <ul style="list-style-type: none"> - Formal discussion of long-run behavior - Balance and detailed balance <p>Checkpoint is based on Sections 10.1-10.3</p>	<p>Wednesday 9/30</p> <p>Ch 11:</p> <ul style="list-style-type: none"> - Konstantopolous Ex 7 - Ex 3 - Idea for Ex 1 	<p>Ch 11</p> <ul style="list-style-type: none"> - Ex 1, 2, 4, 5 - Kontantopolous Ex 25, 27
Ch 11	<p>Detailed Balance and MCMC</p> <ul style="list-style-type: none"> - 11.1 is about different kinds of balance, and how one of them can make it easy to identify the other - 11.2 solves the code-breaking problem with a tiny alphabet, by complete enumeration - 11.3 develops a general Markov chain Monte Carlo method that can be used to solve the problem with a large alphabet 	<p>Thursday 10/1</p> <ul style="list-style-type: none"> - The code breaking problem, with a tiny alphabet - Using MCMC to solve the problem with a large alphabet 	<p>Friday 10/2</p> <p>Lab 3. Please attend – the lab will make much more sense if you do, and it's one of our rare one-week labs.</p>	

There are no exercises at the end of Chapter 10, because the methods of Chapter 11 make many problems easier to solve.